

CONTRIBUTIONS TO THE MOSQUITO FAUNA OF SOUTHEAST ASIA. XVII

THE CAMBODIAN *Aedes* (*Neomacleaya*) SPECIES

WITH SOME NEW DESCRIPTIONS (DIPTERA: CULICIDAE)<sup>1</sup>

By

J. M. Klein<sup>2</sup>

ABSTRACT

These notes concern new descriptions, distribution and biology of the *Aedes* (*Neomacleaya*) species, which were collected by the author in Cambodia from 1966 to 1970. Fifteen species have been recorded, of which 4 are described as new: *khmerus* n. sp., *kompongus* n. sp., *phnomus* n. sp. and *stungus* n. sp. The unknown females of *cyrtolabis* Edwards and *dermajoensis* Brug are also described and illustrated; finally, complementary descriptions and figures on *fragilis* (Leicester) and *indecorabilis* (Leicester) are given. A key to the adults of this Cambodian fauna is presented in conclusion.

INTRODUCTION

Up to the present a single species in this subgenus, namely, *Neomacleaya vallistris* has been reported from Cambodia (Delfinado 1968: 3). The present addition of 10 known species and 4 new ones to the fauna is therefore quite a considerable advance in our knowledge of the fauna of Southeast Asia. These new records show the presence either of species known to have a wide distribution both east and west of Cambodia or to occur in neighbouring countries as shown in the following summary:

*andamanensis*, Andaman Islands, Philippines, Thailand, India,  
Malaya, Sumatra, Java, N. Borneo, Vietnam,  
Cambodia.

*clavatus*, India, Thailand, Vietnam, Cambodia.

*cretatus*, Thailand, Cambodia.

*cyrtolabis*, Singapore, Thailand, Cambodia.

*dermajoensis*, Sumatra, Thailand, Cambodia.

*dux*, Philippines, Andaman Islands, Thailand, Java,  
Hainan Island, Vietnam, Cambodia.

<sup>1</sup> Supported in part by Research Contract No. DA-49-193-MD-2672 from the U.S. Army Medical Research and Development Command, Office of the Surgeon General, Washington, D.C.

<sup>2</sup> Office de la Recherche scientifique et technique Outre-Mer, Paris.



<i>fragilis</i> ,	Malaya, Cambodia.
<i>indecorabilis</i> ,	Malaya, Thailand, N. Borneo, Cambodia.
<i>notabilis</i> ,	Thailand, Cambodia.
<i>uncus</i> ,	Philippines, Thailand, Java, N. Borneo, Malaya, Sarawak, India, Cambodia.

Knowledge of the immatures of *Neomacleaya* unfortunately has not been advanced. The summary given by Delfinado (1968), showed that of 42 species known at that time neither the larva nor the pupa of 23 had been described. Now 4 more must be added to the latter.

The present contribution adds considerably to our knowledge of the habits of adults. Previously 4 species, *cautus*, *panayensis*, *uncus* and *siamensis* were known to bite man. At one place in Thailand the last mentioned (fide E. L. Peyton) occurred in large numbers during the day resting around a ground pool. They fed freely on man and a number of progeny were subsequently reared from eggs laid by them. The present contribution now adds 9 more to the man-biting list, namely *andamanensis*, *clavatus*, *cretatus*, *cyrto-labis*, *dermajoensis*, *fragilis*, *indecorabilis*, *vallistris* and *stungus*. One of these (*vallistris*) is reported as occurring in large numbers near Phnom-Penh during the second half of the rainy season with a maximum in October and biting man freely during the daytime. It does seem strange that there are so few earlier records of biting and one wonders if, because of difficulty of identification, specimens have not been misidentified or perhaps even discarded. The present contribution plus the earlier work of Delfinado should now make it possible to identify the species and it is hoped that the subgenus will receive better attention in the future.

Adults are often caught in vegetation, rockholes and crabholes but only 6 species have been caught in light traps. If the species show a disinclination to enter light traps then this may also account for the fact that there are few records of attempts to isolate viruses from them.

#### *Aedes (Neomacleaya) andamanensis* EDWARDS

*Aedes (Neomacleaya) andamanensis* Edwards 1922, Indian J. med. Res. 10: 272 (♂\*).

*Aedes (Neomacleaya) andamanensis* Edwards, Delfinado 1967, Contr. Amer. ent. Inst. 1(8): 9 (♂\*, ♀\*, L\*, P\*).

DISTRIBUTION and BIOLOGY. CAMBODIA. Adults. *Kandal*: Takmau 2♂, Oct. 1967, resting on low vegetation in gardens; *Kompong Speu*: Kirirom rainforest 3♂, 2♀, Apr. 1968, resting in rockholes; *Kompong Sela*: Stung Chral rainforest 1♀, March 1970, biting man at 10 pm; *Battambang*: Pailin forest 1♀, Apr. 1969, biting man at 6 pm. Larvae. *Kandal*: Dey Eth, July 1967, in shaded muddy road ruts; *Kompong Speu*: Kirirom hills, May 1968, in residual pools of irrigated fields drying up; *Kompong Sela*: Stung Chral, June 1968 and June 1969, in shaded pools on edges of torrents.

#### *Aedes (Neomacleaya) clavatus* BARRAUD

*Aedes (Aedes) clavatus* Barraud 1931, Indian J. med. Res. 19: 614 (♂\*).

*Aedes (Neomacleaya) clavatus* Barraud, Delfinado 1967, Contr. Amer. ent. Inst. 1(8): 13 (♂\*, ♀\*).



DISTRIBUTION and BIOLOGY. CAMBODIA. Adults. *Kompong Speu*: Kirirom rainforest 2♂, March 1969, resting on low vegetation; *Kompong Sela*: Stung Chral Febr. 1970, 2♂ resting on low vegetation, 9♀ biting man between 7 am and 5 pm; *Kompong Som*: Tuk Sap, sublittoral rainforest 1♀, March 1970, biting man at 4 pm. Larvae. *Kompong Sela*: Stung Chral, June 1968, in rock pools.

#### *AEDES (NEOMACLEAYA) CRETATUS DELFINADO*

*Aedes (Neomacleaya) cretatus* Delfinado 1967, Contr. Amer. ent. Inst. 1(8): 14 (♂\*, ♀\*, L\*, P\*).

DISTRIBUTION and BIOLOGY. CAMBODIA. Adults. *Kompong Sela*: Stung Chral rainforest 1♀, March 1970, biting man at 8 am. Males reared. Larvae. *Kompong Speu*: Kirirom rainforest, Febr. 1968, in shaded pools along edges of torrents; *Kompong Sela*: Stung Chral rainforest, March 1970, in stream pools.

#### *AEDES (NEOMACLEAYA) CYRTOLABIS EDWARDS*

(Fig. 5)

*Aedes (Aedes) cyrtolabis* Edwards 1928, Bull. ent. Res. 18: 273 (♂\*);

Edwards and Given 1928, Bull. ent. Res. 18: 344 (L\*).

*Aedes (Neomacleaya) cyrtolabis* Edwards, Delfinado 1967, Contr. Amer. ent. Inst. 1(8): 16 (♂\*, L\*, P\*).

Species characterized as follows: 1. Pale lateral patches on abdominal terga. 2. No scales on anterior lobe of pronotum nor on postspiracular area. 3. Fine hairs on anterior portion of sternopleuron and on lower mesepimeron. 4. Hind claws equal and simple in both sexes, fore and midclaws unequal in male with only the larger claw toothed, equal in female, each claw toothed. 5. Terminalia in male as figured by Delfinado (1967, Fig. 7) and in female as here in Fig. 5.

**FEMALE.** *Head*. Vertex dark, with pale lateral patches and pale scales along the eye margin; upright brown scales confined to the occiput; torus with minute hairs and some little scales on inner side; palpus short, about 1.5 / 10 the length of proboscis; proboscis slightly longer than fore femur (10/9), dark brown. *Thorax*. As described for male. In addition to bristles and narrow curved scales on posterior part of pronotum, there are fine hairs, mainly in lower and posterior part. *Wing*. Alula fringed with some broad scales. *Legs*. Hind claws equal and simple; fore and mid claws equal, each claw toothed (Fig. 5). *Abdomen*. Terga dark with oblique pale lateral patches not produced on to dorsum; sterna with basal half or 2/3 pale scaled. *Terminalia* (Fig. 5). Cercus elongate, about two times as long as basal width; postgenital plate broad with a wide and deep emargination; postatrial sclerite rounded with 2 large convex lateral lobes; postatrial plate triangular with an angulated apical structure and a cordate opening with many fine hairs in front of it and basally; preatrial plate heart-shaped with a deep median emargination distally; 3 unequal ovate spermathecae, each with a short neck.

**TYPE DATA.** Female plesiotype (no. 507, with slide of terminalia, in USNM), Phnom Praung, *Kompong Sela*, CAMBODIA, May 1969. Other examined material, with slides of terminalia: 7♂, 6♀, same locality, July 1968 and May 1969; 1♂ Tuk Sap, *Kompong Som*, Dec. 1969 and 1♂ Sihanoukville, *Kompong Som*, Jan. 1967 (3♂, 3♀ with slides of terminalia in USNM, others in Centre ORSTOM, Bondy, France).



**TAXONOMIC DISCUSSION.** On external characters *cyrtolabis* appears to be indistinguishable from *uncus*, *protuberans* and *torosus*. Females of the two last species are still unknown. Females of *cyrtolabis* and *uncus* are well differentiated by their terminalia, in particular by their postgenital, postatrial and preatrial plates.

**DISTRIBUTION and BIOLOGY.** CAMBODIA. Adults. *Kompong Sela*: Phnom Praung 5♂, 3♀, July 1968 and May 1969, resting on low vegetation; *Kompong Som*: Sihanoukville littoral rainforest 2♀, Dec. 1966 and July 1969, biting man in daytime and 3♂, Jan. 1967, resting on low vegetation; Tuk Sap sublittoral rainforest 4♂, Dec. 1969, resting on low vegetation. Larvae. *Kompong Sela*: Phnom Praung, May and July 1968, in jungle pools

### *Aedes (Neomacleaya) dermajoensis* BRUG

(Figs. 1, 2)

*Aedes (Aedes) dermajoensis* Brug 1931, Tijdschr. Ent. 74: 250 (♂\*).

*Aedes (Neomacleaya) dermajoensis* Brug, Delfinado 1967, Contr. Amer. ent. Inst. 1(8): 17 (♂\*, P\*).

Species characterized as follows: 1. Pale basal bands on abdominal terga complete in male, mostly broken in female. 2. No scales on anterior lobe of pronotum, nor on postspiracular area. 3. No fine hairs on anterior portion of sternopleuron, nor on lower mesepimeron. 4. Hind claws equal and simple in both sexes, fore and mid claws unequal in male, equal in female, each claw toothed. 5. Terminalia as figured by Delfinado (1967, Fig. 8) and here in Figs. 1 and 2.

**FEMALE.** *Head.* Vertex brown, with pale lateral patches, some broad or narrow pale yellowish scales on the middle; upright brown scales confined to the occiput; torus with a few small scales on inner side; palpus short, about 1.5/10 the length of the proboscis; proboscis longer than fore femur (8/7), dark brown. *Thorax.* As described in Delfinado (1967: 18) in male, with following addenda: posterior part of pronotum with many narrow curved brown scales; postspiracular area with 3 or 4 bristles and no scales; no fine hairs on anterior portion of sternopleuron, or only with 1-3 near the upper scale patch. *Wing.* Alula fringed with some broad elongated brown scales. *Legs.* Hind claws equal and simple; fore and mid claws equal, each claw toothed. *Abdomen.* Terga II-VI with pale mediobasal bands and oblique lateral patches; sometimes basal bands and lateral patches are in contact or even form a complete basal band as it is usual in male; sterna pale scaled in basal half, more densely on the sides. *Terminalia* (Fig. 2). Cercus a little shorter than two times the basal width; postgenital plate broad, with a very shallow emargination; postatrial sclerite rounded; postatrial plate pocket-shaped, with its outer wall covered with short hairs; preatrial plate represented by 2 small hairy surfaces, poorly sclerotized; 3 unequal spermathecae, each with a long narrow neck.

**TYPE DATA.** Female plesiotype (no. 628, with slide of terminalia, in USNM), Sihanoukville, *Kompong Som*, CAMBODIA, March 1970. Other examined material, with slides of terminalia: 8♂, 7♀, May to July 1969 and Febr. 1970, Stung Chral, *Kompong Sela*; 2♂, July 1968, Angkor forest, *Siem Reap* (3♂, 3♀ in USNM, others in Centre ORSTOM, Bondy).

**TAXONOMIC DISCUSSION.** The females ascribed here to *dermajoensis* were collected in association with males belonging to this species. The terminalia of these males present an apical process of basimere which is gently rounded or with a smooth pointed apex, as in Fig. 1, never distinctly pointed as figured by Delfinado (1967, Fig. 8). According to Dr. Botha de Meillon (pers. com.), one specimen from Thailand in USNM has a rounded



apical process, and Brug's original illustration shows a somewhat intermediate condition.

Female terminalia of *dermajoensis* are of the same type as those of *panayensis*, *incertus* and the here below described *khmerus* n. sp. The pocket-shaped postatrial plate is wrinkled in *panayensis*, smooth in *incertus* and *khmerus* n. sp. and hairy in *dermajoensis*. Externally, *panayensis* is easy to recognize by the pale scaling of the anterior lobe of pronotum, and *khmerus* n. sp. by its many hairs on anterior portion of sternopleuron and the pale scaling of postspiracular area. It may be difficult to differentiate externally *dermajoensis* from *cretatus* and from *incertus*, which may have the same type of abdominal scaling.

DISTRIBUTION and BIOLOGY. CAMBODIA. Adults. *Siem Reap*: Angkor forest, 12♂, 8♀, July 1968, resting on low vegetation; *Kompong Sela*: Stung Chral forest, 16♂, 10♀, May to July 1969 and Febr. 1970, resting on low vegetation; *Kompong Som*: Sihanoukville littoral rainforest, 3♀, March 1970, biting man between 2 and 6 pm. Larvae. Not found.

#### *Aedes* (*NEOMACLEAYA*) *DUX* DYAR AND SHANNON

*Aedes* (*Aedes*) *dux* Dyar and Shannon 1925, Insect. Inscit. menst. 13: 81 (♂, ♀); Laffoon 1946, J. Wash. Acad. Sci. 36: 233 (♂\*, ♀\*, L\*); *Aedes* (*Neomacleaya*) *dux* Dyar and Shannon, Delfinado 1967, Contr. Amer. ent. Inst. 1(8): 18 (♂\*, ♀\*, L\*, P\*).

DISTRIBUTION and BIOLOGY. CAMBODIA. Adults. *Kandal*: Chruir Changwar, in the suburb of Phnom-Penh, 1♂, May 1967, in a light trap, near cattle. Females not found. Larvae. Not found.

#### *Aedes* (*NEOMACLEAYA*) *FRAGILIS* LEICESTER

(Fig. 9)

*Verrallina fragilis* Leicester 1908, Cul. Malaya 3: 199 (♂).  
*Verrallina malayi* Leicester 1908, Cul. Malaya 3: 198 (♀); Laffoon 1946, J. Wash. Acad. Sci. 36: 238.  
*Aedes fragilis* (Leicester), Edwards 1917, Bull. ent. Res. 7: 222 (♂\*).  
*Aedes* (*Neomacleaya*) *fragilis* (Leicester), Delfinado 1968, Contr. Amer. ent. Inst. 2(4): 15 (♂\*, ♀\*).

As female terminalia of *fragilis* are only schematically represented in Delfinado (1968, Fig. 8) and not at all in older descriptions, I draw them here (Fig. 9) tentatively from 2 females assigned to this species on following characters: 1. Pale lateral patches on abdominal terga. 2. Pale scales on anterior lobe of pronotum, but no scales on postspiracular area. 3. No fine hairs on anterior portion of sternopleuron, nor on lower mesepimeron. 4. Proboscis as long as fore femur. 5. All female claws equal and toothed. 6. Female terminalia as described and represented in Delfinado (1968). We note that the horseshoe-shaped postatrial plate has broad flat extensions, one on the top and one on each side at base; preatrial plate large, bulbous and hairy; preatrial sclerite laterally widened; 3 unequal spermathecae without neck; sternum VIII with 2 apical paramedian rounded lobes bearing strong bristles.

MATERIAL EXAMINED. 1♀ (no. 657, with slide of terminalia, in USNM), March 1970, Tuk Sap, *Kompong Som*, CAMBODIA; 1♀ (no. 514, with slide of terminalia, in Centre ORSTOM, Bondy), July 1968, Phnom Praung, *Kompong Sela*, CAMBODIA.

TAXONOMIC DISCUSSION. As discussed under *stungus* n. sp.



DISTRIBUTION and BIOLOGY. CAMBODIA. Adults. *Kompong Sela*: Phnom Praung rainforest, 1♀, July 1968, biting man at 1 pm; *Kompong Som*: Tuk Sap sublittoral rainforest, 1♀, March 1970, biting man at 4 pm.

*Aedes (Neomacleaya) indecorabilis* (LEICESTER)

(Figs. 7, 8)

*Verrallina indecorabilis* Leicester 1908, Cul. Malaya 3: 200 (♂, ♀).

*Verrallina imitator* Leicester 1908, Cul. Malaya 3: 201 (♀); Stone, Knight and Starcke 1959, Thomas Say Found., Ent. Soc. Amer. 6: 206 (synonymy).

*Aedes (Neomacleaya) indecorabilis* (Leicester), Delfinado 1967, Contr. Amer. ent. Inst. 1(8): 25 (♂\*, ♀\*).

Species characterized as follows: 1. No definite pale lateral patches on abdominal terga, but dull pale scales distributed laterally on the whole length of terga. 2. Pale scales on anterior lobe of pronotum, but no scales on postspiracular area. 3. No fine hairs on anterior portion of sternopleuron, nor on lower mesepimeron. 4. Hind claws equal and toothed in both sexes; fore and mid claws unequal in male, equal in female, each claw toothed. 5. Terminalia as described and figured by Delfinado (1967, Figs. 13, 20) and here, in Figs. 7, 8.

We note that in male terminalia, apex of basimere is darkened by a sclerotization bearing a fine hair inserted in an apical concavity. In female terminalia, postatrial plate is horseshoe-shaped, with a nearly rounded opening; preatrial plate bulbous and hairy, widely open laterally; preatrial sclerite M-shaped with widened lateral branches; 3 unequal spermathecae without neck; sternum VIII with 2 apical paramedian rounded lobes bearing strong bristles.

MATERIAL EXAMINED. 4♂, 5♀, with slides of terminalia, Nov. 1967, July and Oct. 1968, May 1969, Phnom Praung, *Kompong Sela*, CAMBODIA; 1♀, Dec. 1969, Sihanoukville, *Kompong Som* (2♂, 3♀ with slides of terminalia in USNM, others in Centre ORSTOM, Bondy).

TAXONOMIC DISCUSSION. The apical sclerotized part of the basimere in male *indecorabilis* is not accurately represented in Delfinado (1967, Fig. 13) and it is confirmed by Dr. Botha de Meillon (pers. com.) that the structure with an apical seta, as shown in our Fig. 7, is observable in one of the *indecorabilis* terminalia preparations in USNM from Thailand. Dr. Delfinado did not dispose of any male specimen other than the type in BM and it appears that fore and mid claws could not be re-examined thoroughly. Leicester (1908: 201) described "fore and mid unguis markedly unequal, the larger unguis uniserrate," but the tooth of the small claw may have been overlooked without a fine preparation. Our slides concerning 3♂ show distinctly that the small claw of each pair is also toothed.

Externally *indecorabilis* in either sex is recognizable by the dull palish scaling of the abdominal terga laterally; this differentiates it from *fragilis*, which has definite lateral patches, and from *uniformis*, whose terga are wholly dark.

DISTRIBUTION and BIOLOGY. CAMBODIA. Adults. *Kompong Sela*: Phnom Praung rainforest, 4♂, 3♀, Nov. 1967, July and Oct. 1968 and May 1969, resting in low vegetation, and 2♀, Nov. 1968, biting man in daytime; *Kompong Som*: Sihanoukville littoral rainforest, 2♀, Dec. 1969, biting man at 3 pm. Larvae. *Kompong Sela*: Phnom Praung, June 1967, in jungle pools.



*AEDES (NEOMACLEATA) KHMERUS* n. sp.

(Figs. 3, 4)

Species characterized as follows: 1. Pale lateral patches on abdominal terga. 2. No scales on anterior lobe of pronotum, but some pale scales on postspiracular area. 3. Many fine hairs on anterior portion of sternopleuron, but no hairs on lower mesepimeron, nor on metameron. 4. Hind claws equal and simple, fore and mid claws unequal in male, equal in female, each claw toothed. 5. Terminalia as in Figs. 3 and 4.

**FEMALE.** *Head.* Vertex brown, with lateral pale scale patches; some broad and narrow pale scales on the middle of vertex; upright brown scales confined to the occiput; torus with some minute hairs and small scales on inner side; palpus short, about 1/7 the length of proboscis; proboscis longer than fore femur (8/7), dark brown. *Thorax.* Scutal and scutellar scales dark or golden brown on dark or reddish brown integument; anterior lobe of pronotum with 8 to 10 bristles, without scales; posterior part of pronotum with 4 or 5 bristles, many narrow curved golden brown scales and sometimes 1 to 5 pale broad or elongated curved scales; postspiracular area with 5 to 8 bristles and 1 to 5 pale scales, broad or narrow and curved; sternopleuron with loosely arranged pale scale patches, lower patch mixed with fine hairs, some bristles behind upper scale patch, and many fine hairs on anterior portion; lower mesepimeron bare; metameron bare; propleuron with pale scales and bristles.

*Wing.* Alula fringed with some broad brown scales. *Legs.* Fore coxa brown scaled, with a pale spot above; mid and hind coxae with some pale scales; hind claws equal and simple, fore and mid claws equal, each claw toothed. *Abdomen.* Terga dark brown with lateral oblique pale patches, not or slightly produced on to dorsum; sterna pale scaled in basal half, more densely on sides.

*Terminalia.* As in Fig. 4. Cercus short; postgenital plate broad with a shallow emargination; postatrial plate pocket-shaped with lateral arms and without hairs; preatrial plate represented by 2 poorly sclerotized hairy surfaces; 3 unequal spermathecae, each with a long narrow neck.

**MALE.** General habitus as in female. There are no pale scales visible on postspiracular area, nor on posterior part of pronotum, but they may be rubbed off, as many scales of thorax are lacking on our 2 specimens; fine hairs on anterior part of sternopleuron not so numerous as in female, but up to 10 or 12. *Legs.* Hind claws equal and simple; fore and mid claws unequal, each claw toothed. *Abdomen.* Terga with pale lateral patches, produced on to dorsum, but not forming complete subbasal bands. *Terminalia.* (Fig. 3). Basimere short, without apical projection, but with 2 large spines and a patch of hairs inserted near base, and a flattened median projection with a hairy tip; distimere expanded in the middle, narrowed and hook-shaped at apex; aedeagus of *andamanensis* type; paraproct very small.

**LARVA and PUPA.** Unknown.

**TYPE DATA.** Holotype ♀ (no. 380, with slide of terminalia and claws, in USNM), Aug. 1967, Sre Klong, *Kompong Speu*, CAMBODIA; allotype ♂ (no. 497, with slide of terminalia, in USNM), June 1968, Kirirom hills, *Kompong Speu*; 7♀, 1♂ paratypes, Aug. and Sept. 1967, Sre Klong, *Kompong Speu* (3♀ in USNM, others in Centre ORSTOM, Bondy).

**TAXONOMIC DISCUSSION.** Female terminalia of *khmerus* n. sp. are nearest to those of *incertus*, having a similar smooth pocket-shaped postatrial plate; *khmerus* n. sp. may be easily differentiated externally by its many hairs on anterior portion of sternopleuron and pale scaling of postspiracular area. Male terminalia of *khmerus* n. sp. are nearest to those of *varus*, but differ by the median flattened projection of basimere, whose apex is hairy in the first and denticulated in the second; other differences exist in basal spines and patch of hairs on inner margin of basimere, others in distimere and structure of phallosome; externally the two species may be indistinguishable when the pale scales of postspiracular area in *khmerus* n. sp. are rubbed off.



DISTRIBUTION and BIOLOGY. CAMBODIA. Adults. *Kompong Speu*; Sre Klong forest, 1♂, 7♀, Aug. and Sept. 1967, resting on low vegetation; Kirirom hills rainforest, 1♂, 1♀, June 1968, resting on low vegetation. Larvae. Not found.

*Aedes (Neomacleaya) kompongus* n. sp.

(Fig. 11)

Based only on 2 male specimens, female, larva and pupa being unknown. Species characterized as follows: 1. Lateral pale patches on abdominal terga produced on to dorsum. 2. Pale broad scales on postspiracular area and 1 or 2 narrow curved pale scales on anterior lobe of pronotum. 3. No fine hairs on anterior portion of sternopleuron, nor on lower mesepimeron. 4. Hind claws equal and simple, fore and mid claws unequal, only the larger claw toothed. 5. Terminalia as in Fig. 11.

MALE. *Head*. Vertex dark brown, with a few pale broad scales on the sides and pale narrow scales on the middle; dark upright scales confined to the occiput; torus bare or with one minute hair or scale on inner side; antenna strongly plumose; palpus short, about 1/8 the length of proboscis; proboscis dark brown, about as long as fore femur. *Thorax*. Scutal and scutellar scales brown to golden, lighter on front margin of scutum; anterior lobe of pronotum with 7 or 8 bristles and 1 or 2 narrow curved pale scales, inserted near anterior border; posterior part of pronotum with 3 bristles and from 4 to 12 narrow golden brown scales; postspiracular area with 2 bristles and 2 or 3 pale broad scales; sternopleuron with anterior portion bare, upper scale patch with a row of 6 or 7 bristles behind and lower patch mixed with some hairs and some bristles behind; lower mesepimeron bare; metameron bare. *Wing*. Alula fringed with some narrow scales. *Legs*. Dark scaled, the femora pale ventrally; fore coxal scale patch brownish with pale scales above and below; mid and hind coxae each with some pale scales; hind claws equal and simple; fore and mid claws unequal, only the larger being toothed. *Abdomen*. Terga dark brown, with pale lateral patches curved and produced on to dorsum, but not forming complete subbasal bands; sterna pale scaled on basal half. *Terminalia*. (Fig. 11). Basimere produced apically into a large process divided into 2 or 3 finger-like projections, and an inner basal lobe with 3 or 4 blunt spines and some bristles; distimere inserted subapically, slightly curved and evenly tapered; paraproct developed into darkened triangular blades with a denticulated apical margin and an inner apical blunt pointed apex; aedeagus of the *andamanensis* type.

FEMALE, LARVA and PUPA. Unknown.

TYPE DATA. Holotype ♂ and 1 paratype ♂ (with slides of terminalia, in USNM), Febr. 1968, ex pupae, Kirirom hills, *Kompong Speu*, CAMBODIA.

TAXONOMIC DISCUSSION. Terminalia of *kompongus* n. sp. are very distinctive and externally the described males do not seem to belong to one of the species known only by their females. Between these, the nearest may be *hispidus*, which has, like *kompongus* n. sp. pale scaling on postspiracular area; but its anterior lobe of pronotum is described as having narrow golden scales and abdominal terga as being completely banded.

DISTRIBUTION and BIOLOGY. CAMBODIA. Adults. The new species is known only from 2 males reared from pupae, collected in a little grassy pool on the edge of a torrent in rainforest.



*AEDES (NEOMACLEAYA) NOTABILIS* DELFINADO

*Aedes (Neomacleaya) notabilis* Delfinado 1967, Contr. Amer. ent. Inst. 1(8): 28 (♀\*).

The single female described by Delfinado has the fore legs missing. I therefore mounted all legs of my specimen and noted: equal and simple hind claws (not toothed as described), equal fore and mid claws, each claw toothed.

DISTRIBUTION and BIOLOGY. CAMBODIA. Adults. *Kompong Sela*: Stung Chral rainforest, 1♀, July 1969, resting on low vegetation. Males not found. Larvae. Not found.

*AEDES (NEOMACLEAYA) PHNOMUS* n. sp.

(Fig. 10)

Based only on a unique male specimen, female, larva and pupa being unknown. Species characterized as follows: 1. Lateral pale patches on abdominal terga produced on to dorsum. 2. Pale broad scales on postspiracular area and apparently also some on anterior lobe of pronotum. 3. No fine hairs on anterior portion of sternopleuron, nor on lower mesepimeron. 4. Hind claws equal and simple; fore and mid claws unequal, each claw toothed. 5. Terminalia as in Fig. 10.

MALE. *Head*. Vertex dark brown with pale broad scales on the middle and on the sides; some dark upright scales confined to occiput; torus with some minute hairs on inner side; palpus short, about 1/8 the length of proboscis; proboscis dark, longer than fore femur (8/7). *Thorax*. Scutal and scutellar scales golden brown, lighter on front margin of scutum; anterior lobe of pronotum with 3 or 4 broad pale scales on anterior border (but may be rubbed from the vertex), 6 to 8 bristles and behind them 5 to 8 hairs; posterior pronotum with narrow golden brown scales and 3 or 4 bristles; postspiracular area with 2-4 pale broad scales and 3 bristles; sternopleuron with anterior portion bare, upper scale patch with a row of 5 bristles behind and a lower patch mixed with some hairs; upper part of mesepimeron with a large patch of scales and no hairs behind; lower mesepimeron bare; metameron bare. *Wing*. Alula fringed with narrow or lanceolate scales. *Legs*. Dark brown, the femora pale ventrally; fore coxa brown scaled, with a pale spot above; mid and hind coxae with some pale scales; hind claws equal and simple; fore and mid claws unequal and each claw toothed. *Abdomen*. Terga dark, with pale lateral patches extending on to dorsum, but not forming complete subbasal bands; sterna not visible. *Terminalia* (Fig. 10). Basimere with a straight apical projection, in side view curved and tapering, with a short rounded apex in lateral position, and an inner basal lobe, bearing a group of strong bristles, 2 dark long spines and a longer pointed process, all nearly straight; distimere slender, curved upwards and tapered to a pointed tip; aedeagus simple, of the *andamanensis* type; paraproct enlarged at base, slightly curved inwards and pointed distally.

FEMALE, LARVA and PUPA. Unknown.

TYPE DATA. Holotype ♂ (no. 802, legs on one side missing, with slide of terminalia, in USNM), Nov. 1970, Chruai Changwar, *Kandal*, CAMBODIA.

TAXONOMIC DISCUSSION. Male terminalia of *phnomus* n. sp. are near to those of *indicus*, but Barraud (1934: 283) described these as having on basimere "a single slender elbowed process, arising from inner surface of coxite; no spines at ventral root." Externally, *phnomus* n. sp. does not fit the description of *indicus*, which has a postspiracular area with narrow curved golden scales, according to Delfinado (1967: 24). *A. phnomus* n. sp. is near



to the species having pale scaling on postspiracular area and on anterior lobe of pronotum, in particular to *vallistris*, from which it is well differentiated by the male fore and mid claws being all toothed and by the terminalia.

DISTRIBUTION and BIOLOGY. CAMBODIA. Adults. The new species is known only from a single male, collected in a light trap, near cattle.

*AEDES (NEOMACLEAYA) STUNGUS* n. sp.

(Fig. 6)

Based on only 3 females, male, larva and pupa being unknown. Species characterized as follows: 1. Pale lateral patches on abdominal terga. 2. Proboscis distinctly shorter than fore femur. 3. Pale scales on anterior lobe of pronotum, but no scales on postspiracular area. No fine hairs on anterior portion of sternopleuron, nor on lower mesepimeron. 5. All claws equal, each being toothed. 6. Terminalia as in Fig. 6.

FEMALE. *Head*. Vertex dark brown, with pale lateral patches and pale scales along the eye margin; dark upright scales confined to occiput; torus with some small scales on inner side; palpus short, about 1/6 the length of proboscis; proboscis shorter than fore femur (6/7 or 5/6), dark brown. *Thorax*. Scutal and scutellar scales dark to golden brown on light brown integument; anterior lobe of pronotum with 5 or 6 bristles and many broad pale scales; posterior part of pronotum with 4 or 5 bristles near posterior border and without scales; postspiracular area with 2 or 3 bristles and without scales; sternopleuron with lower patch of scales mixed with fine hairs and without hairs on anterior portion; upper mesepimeron with a patch of scales without hairs behind; lower mesepimeron bare; propleuron with pale scales and bristles. *Wing*. Alula fringed with narrow scales. *Legs*. Dark scaled, mid and hind femora extensively pale scaled ventrally; hind claws equal and toothed; fore and mid claws also equal and toothed. *Abdomen*. Terga dark brown, with pale lateral patches, sometimes well rounded; sterna pale scaled on basal half or 2/3. *Terminalia* (Fig. 6). Cercus long, tapered distally, a little more than twice as long as basal width; postgenital plate rather narrow with a shallow emargination; postatrial plate horseshoe-shaped, dilated at top and with a narrow opening; postatrial sclerite with an internal rib covered with fine hairs in lower part, and an outer rib curved inwards in upper part with a short lateral arm; preatrial plate large, bulbous and hairy; preatrial sclerite M-shaped in the middle with broad lateral extensions; 3 unequal spermathecae without neck; sternum VIII with 2 apical paramedian rounded lobes, bearing strong bristles.

MALE, LARVA and PUPA. Unknown.

TYPE DATA. Holotype ♀ (no. 656, with slide of terminalia, in USNM), July 1969, Stung Chral, *Kompong Sela*, CAMBODIA; 2♀ paratypes, May 1969 and Feb. 1970, same locality. (1♀ paratype in USNM, the other in Centre ORSTOM, Bondy).

TAXONOMIC DISCUSSION. Female terminalia of *stungus* n. sp. with their horseshoe-shaped postatrial plate, are near to those of *indecorabilis*, *fragilis*, *hamistylus*, *pahangi* and *robertsi*, all species having broad pale scales on anterior lobe of pronotum (to be confirmed for *pahangi*) and in females all claws equal and toothed. The last three species have wholly dark abdominal terga and *robertsi* is the only one having a proboscis shorter than fore femur (5/6 or 8.3/10); this has not been mentioned by Laffoon (1946) nor by Delfinado (1968), but has been checked by Dr. Botha de Meillon (pers. com.) on female specimens in USNM. Externally, *robertsi* may be differentiated, besides wholly dark abdominal terga, by the female claws, which have a strongly convex outline, according to the drawing in Delfinado (1968, Fig. 25). In female terminalia, *robertsi* differs in particular by the rib of postatrial sclerite,



which gives rise apically to a much longer lateral arm; there is no inner rib with a hairy lower part and the preatrial M-shaped sclerite forms a much sharper zigzag in the middle part. Female terminalia of *hamistylus* and *pahangi* have strikingly different features of postatrial plate and ribs of postatrial sclerite; those of *indecorabilis* and *fragilis*, incompletely represented in Delfinado (1967, Fig. 20; 1968, Fig. 8), have been figured here (Figs. 7, 8 and 9). We note also, that among the *Aedes (Neomacleaya)* species, whose females are still unknown, none seems to have the same combination of external characters in their described males, as the female of *stungus* n. sp.

DISTRIBUTION and BIOLOGY. CAMBODIA. Adults. This new species is known only from 3 females, collected in the rainforest of Stung Chral, *Kompong Sela*, May and July 1969 and Febr. 1970, of which 2 were resting on low vegetation and one was biting man at 2 pm.

#### *Aedes (NEOMACLEAYA) UNCUS* (THEOBALD)

*Culex uncus* Theobald 1901, Mon. Cul. 2: 53 (♀\*); Laffoon 1946, J. Wash.

Acad. Sci. 36: 237 (♂\*, ♀\*).

*Aedes (Neomacleaya) uncus* (Theobald), Delfinado 1967, Contr. Amer. ent. Inst. 1(8): 30 (♂\*, ♀\*, P\*).

DISTRIBUTION and BIOLOGY. CAMBODIA. Adults. *Kompong Som*: Sihanoukville littoral rainforest, 1♂, Dec. 1966, resting on low vegetation; *Kompong Speu*: Sre Klong forest, 5♂, 3♀, Aug. 1967 and June 1968, resting on low vegetation; Kirirom rainforest, 3♂, March 1969, resting in rock holes; *Kompong Sela*: Stung Chral rainforest, 12♂, 6♀, June 1968, resting on low vegetation and 16♀, Febr. 1970, biting man between 5 am to 5 pm, mainly between 7 am to 11 am. Larvae. *Kompong Sela*: Phnom Praung rainforest, May 1968 and Stung Chral rainforest, June 1968, in jungle pools.

#### *Aedes (NEOMACLEAYA) VALLISTRIS* BARRAUD

*Aedes (Aedes) vallistris* Barraud 1928, Indian J. med. Res. 16: 369 (♂\*, ♀\*); Barraud 1934, Fauna Brit. India, Diptera 5: 290 (♂\*, ♀\*); Iyengar and Menon 1956, Bull. ent. Res. 47: 791 (♂).

*Aedes (Neomacleaya) vallistris* Barraud, Delfinado 1967, Contr. Amer. ent. Inst. 1(8): 32 (♂\*, ♀\*).

DISTRIBUTION and BIOLOGY. CAMBODIA. Adults. *Kandal*: Phnom-Penh Ville, 1♀, June 1967, in a light trap in gardens; Chruai Changwar, Arey Ksatr, Svay Chrum, Dey Eth, Takmau, all localities near Phnom-Penh, in small forests or nearby fields or gardens, hundreds of females, all through the year from 1967 to 1970, mainly in the second half of the rainy season and in the following months, i.e. from August to March, with a maximum in October, resting in the low vegetation, or biting man in daytime. Between 1965 and 1969, at the Institut Pasteur of Phnom-Penh, 1667 specimens of *vallistris*, collected in the neighbourhood of the town, were pooled in 13 lots and inoculated into suckling mice. No viruses were isolated (Chastel, C., Audebaud, G., Salaun, J. J. and Klein, J. M., unpublished). *Kompong Speu*: Sre Klong forest, 3♀, Aug. 1967, resting on low vegetation; *Kompong Chhnang*: Trapeang Chan forest, 3♀, Dec. 1969 and Jan. 1970, biting man at 4 pm and 11 pm. Males not found. Larvae. Not found.



KEYS TO THE ADULTS OF *NEOMACLEAYA* SPECIES IN CAMBODIA

FEMALES<sup>1</sup>

1	Abdominal terga without definite pale markings . . . . .	2
	Abdominal terga with definite pale markings . . . . .	3
2(1)	Abdominal terga wholly dark or with light brown lateral patches, sometimes with a small lateral whitish spot on tergum I; hind claws simple. Postatrial plate simple, with a pair of hairy finger-like processes (Fig. 9 in Delfinado 1967) . . . . .	<i>dux</i>
	Abdominal terga dark, with the sides dull pale brown; hind claws toothed; postatrial plate horseshoe-shaped (Fig. 8) . . . . .	<i>indecorabilis</i>
3(1)	Abdominal terga with median basal bands, mostly separated on the sides from the lateral patches, sometimes complete, rarely absent . . . . .	4
	Abdominal terga with only lateral pale patches . . . . .	5
4(3)	Postgenital plate with a very shallow median emargination; postatrial plate pocket-shaped, with outer wall covered with short hairs (Fig. 2) . . . . .	<i>dermajoensis</i>
	Postgenital plate with a deep median emargination; postatrial plate with characteristic lateral wing-like structures (Fig. 5 in Delfinado 1967) . . . . .	<i>cretatus</i>
5(3)	Postspiracular area with some broad pale scales . . . . .	6
	Postspiracular area without pale scales . . . . .	9
6(5)	Metameron with fine hairs; postatrial plate with bluntly pointed characteristic distal arms (Fig. 1 in Delfinado 1967) . . . . .	<i>andamanensis</i>
	Metameron without fine hairs; postatrial plate different . . . . .	7
7(6)	Proboscis distinctly shorter than fore femur; hind claws toothed; postatrial plate horseshoe-shaped (Fig. 6) . . . . .	<i>stungus</i> n. sp.
	Proboscis as long as or longer than fore femur; hind claws simple; postatrial plate different . . . . .	8
8(7)	Anterior lobe of pronotum with some pale scales; anterior portion of sternopleuron bare; postatrial plate with numerous long hairs on basal half (Fig. 17 in Delfinado 1967) . . . . .	<i>vallistris</i>
	Anterior lobe of pronotum without pale scales; anterior portion of sternopleuron with numerous fine hairs; postatrial plate pocket-shaped, without hairs (Fig. 4) . . . . .	<i>khmerus</i> n. sp.

<sup>1</sup> Females of *kompongus* n. sp. and *phnomus* n. sp. are still unknown.



9(5)	Anterior lobe of pronotum with some pale scales; hind claws toothed; postatrial plate horseshoe-shaped (Fig. 9) . . . . .	<i>fragilis</i>
	Anterior lobe of pronotum without scales; hind claws simple; postatrial plate different . . . . .	10
10(9)	Lower mesepimeron with numerous fine hairs . . . . .	11
	Lower mesepimeron bare . . . . .	12
11(10)	Postgenital plate with a shallow median emargination; postatrial plate with a cordate opening and many long hairs basally (Fig. 16 in Delfinado 1967) . . . . .	<i>uncus</i>
	Postgenital plate with a deep median emargination; postatrial plate with a characteristic triangular structure covering the cordate opening and numerous hairs in front and basally (Fig. 5) . . . . .	<i>cyrtolabis</i>
12(10)	Postgenital plate with a shallow median emargination; postatrial plate characteristically broadened basally and bearing long coarse hairs around the opening (Fig. 17 in Delfinado 1967) . . . . .	<i>clavatus</i>
	Postgenital plate with a deep median emargination; postatrial plate with 2 characteristic hairy lobed structures basally (Fig. 18 in Delfinado 1967) . . . . .	<i>notabilis</i>

MALES<sup>1</sup>

1	Abdominal terga without definite pale markings . . . . .	2
	Abdominal terga with definite pale marking . . . . .	3
2(1)	Abdominal terga wholly dark, or with light brown lateral patches, sometimes with a small lateral whitish spot on tergum I. Hind claws simple. Basimere not produced distally. Distimere Swollen at base, tapering to a curved tip (Fig. 10 in Delfinado 1967) . . . . .	<i>dux</i>
	Abdominal terga dark, with the sides dull pale brown; hind claws toothed; basimere bluntly produced distally; distimere swollen in the middle, abruptly narrowed and curved distally (Fig. 7) . . . . .	<i>indecorabilis</i>
3(1)	Abdominal terga with median basal bands . . . . .	4
	Abdominal terga with only lateral pale patches . . . . .	5
4(3)	Basimere with a short apical pointed or rounded process and on inner margin 2 spines near base and 1 subapical spine (Fig. 1) . . . . .	<i>dermajoensis</i>

<sup>1</sup> Males of *notabilis* and *stungus* n. sp. are still unknown.



	Basimere with 2 apical processes, the one short and hairy, the other long and slender, and on inner margin a peg-like process and 1-2 large spines near base (Fig. 6 in Delfinado 1967) . . . . .	<i>cretatus</i>	
5(3)	Postspiracular area with some broad pale scales . . . . .	6	
	Postspiracular area without pale scales . . . . .	10	
6(5)	Metameron with fine hairs; basimere produced apically into a large broad process with a deep concave depression at apex and 2 other slender processes (Fig. 2 in Delfinado 1967) . . .	<i>andamanensis</i>	
	Metameron without fine hairs; basimere different . . . . .	7	
7(6)	Each claw of the unequal fore and mid claws toothed . . . . .	8	
	Only the larger claw of the unequal fore and mid claws toothed . . . . .	9	
8(7)	Anterior portion of sternopleuron with numerous fine hairs; basimere without apical projection (Fig. 3) . . . . .	<i>khmerus</i> n. sp.	
	Anterior portion of sternopleuron without fine hairs; basimere with an apical projection (Fig. 10) . . . . .	<i>phnomus</i> n. sp.	
9(7)	Basimere with a short apical and 2 subapical projections and on inner margin a small lobe bearing a group of strong spines; paraproct slender, tapering at apex (Fig. 17 in Delfinado 1967) . . . . .	<i>vallistris</i>	
	Basimere produced apically into a large process divided into 2-3 finger-like projections; paraproct large, broadened and indented at apex (Fig. 11) . . . . .	<i>kompongus</i> n. sp.	
10(5)	Anterior lobe of pronotum with some pale scales; hind claws toothed; basimere joined subapically; distimere expanded at middle (Fig. 8 in Delfinado 1968) . . . . .	<i>fragilis</i>	
	Anterior lobe of pronotum without pale scales; hind claws simple; basimere not joined subapically; distimere different . . . . .	11	
11(10)	Lower mesepimeron bare; paraproct divided; basimere broadly produced distally, with a knob-like process at tip and a short pointed subapical inner projection (Fig. 17 in Delfinado 1967) . . . . .	<i>clavatus</i>	
	Lower mesepimeron with many fine hairs; paraproct not divided; basimere different . . . . .	12	



- 12(11) Paraproct very long and wavy; basimere with a short apical projection and a small subapical thumb-like process (Fig. 7 in Delfinado 1967) . . . . . *cyrtolabis*
- Paraproct very short; basimere with 2 long slender apical projections, the one bearing 2-3 large spines, the other being split at tip (Fig. 19 in Delfinado 1967) . . . . . *uncus*

## ACKNOWLEDGEMENTS

The author is indebted to Dr. Botha de Meillon, Principal Investigator of SEAMP, for advice, helpful re-examination of material in the USNM, reviewing the manuscript and seeing it through the press. The author is also especially appreciative of the assistance of MM. Kim Suor and Lim Thou, from Institut Pasteur of Cambodia, Phnom-Penh, who accompanied him very helpfully on his field trips.

## LITERATURE CITED

## BARRAUD, P. J.

1934. The fauna of British India, including Ceylon and Burma. Diptera 5, family Culicidae, tribes Megarhinini and Culicini. Taylor & Francis, London, 463 pp., illus.

## BRUG, S. L.

1931. New Culicidae from Sumatra. Tijdschr. Ent. 74: 245-250.

## DELFINADO, M. D.

1967. Contributions to the mosquito fauna of Southeast Asia. I. The genus *Aedes*, subgenus *Neomacleaya* Theobald in Thailand. Contr. Amer. ent. Inst. 1(8): 1-35.
1968. Contributions to the mosquito fauna of Southeast Asia. III. The genus *Aedes*, subgenus *Neomacleaya* Theobald in Southeast Asia. Contr. Amer. ent. Inst. 2(4): 1-74.

## EDWARDS, F. W.

1917. Notes on Culicidae, with descriptions of new species. Bull. ent. Res. 7: 201-229.
1928. Mosquito notes. VII. Bull. ent. Res. 18: 267-284.

## LAFFOON, J.

1946. The Philippine mosquitoes of the genus *Aedes*, subgenus *Aedes*. J. Wash. Acad. Sci. 36: 228-245.

## LEICESTER, G. F.

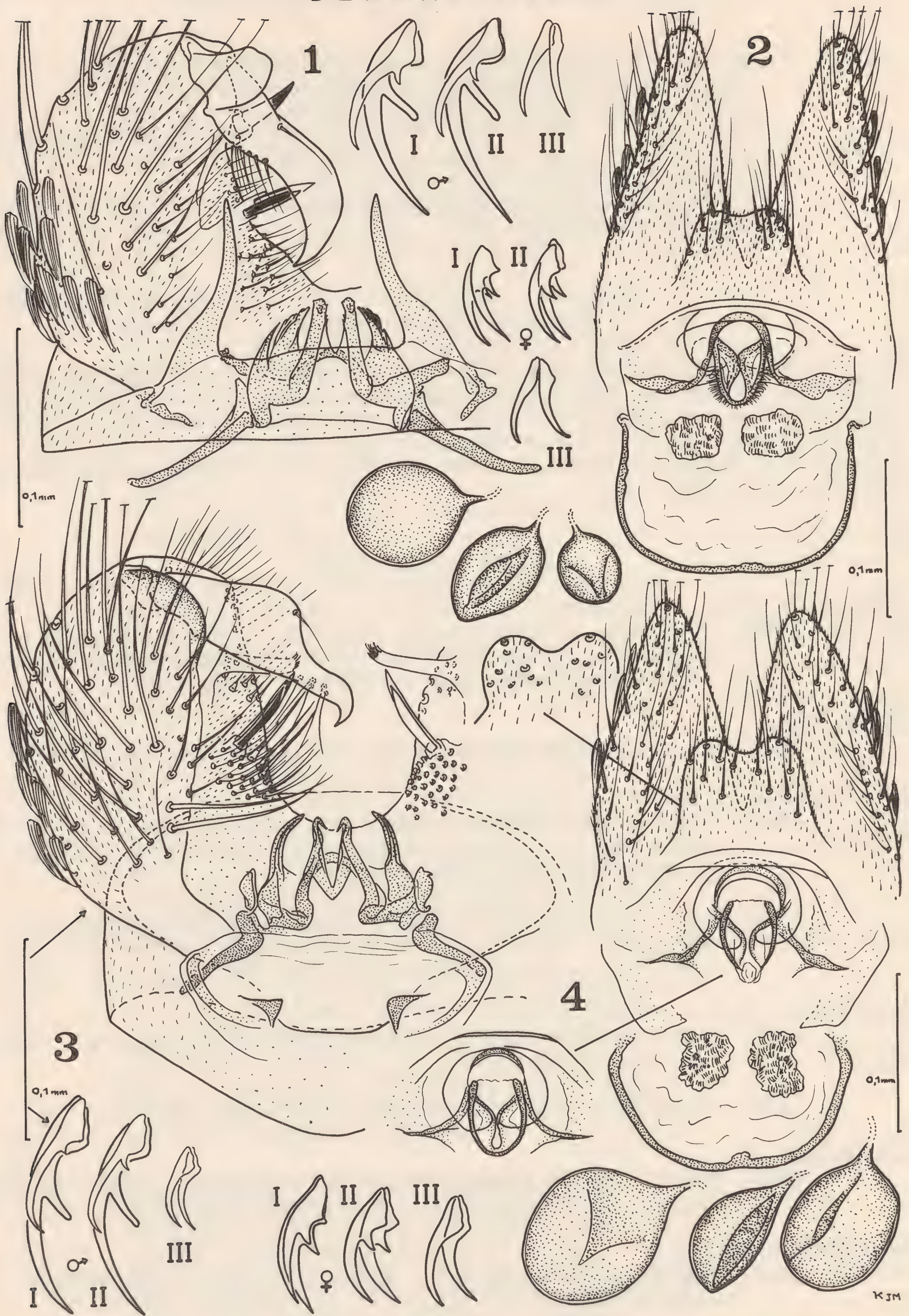
1908. The Culicidae of Malaya. Stud. Inst. med. Res. F.M.S. 3(3): 18-261.

## STONE, A., K. L. KNIGHT and H. STARCKE

1959. A synoptic catalog of the mosquitoes of the world (Diptera: Culicidae). Ent. Soc. Amer. (Thomas Say Found.), Wash., D.C., 358 pp.



# DERMAJOENSIS



KHMERUS

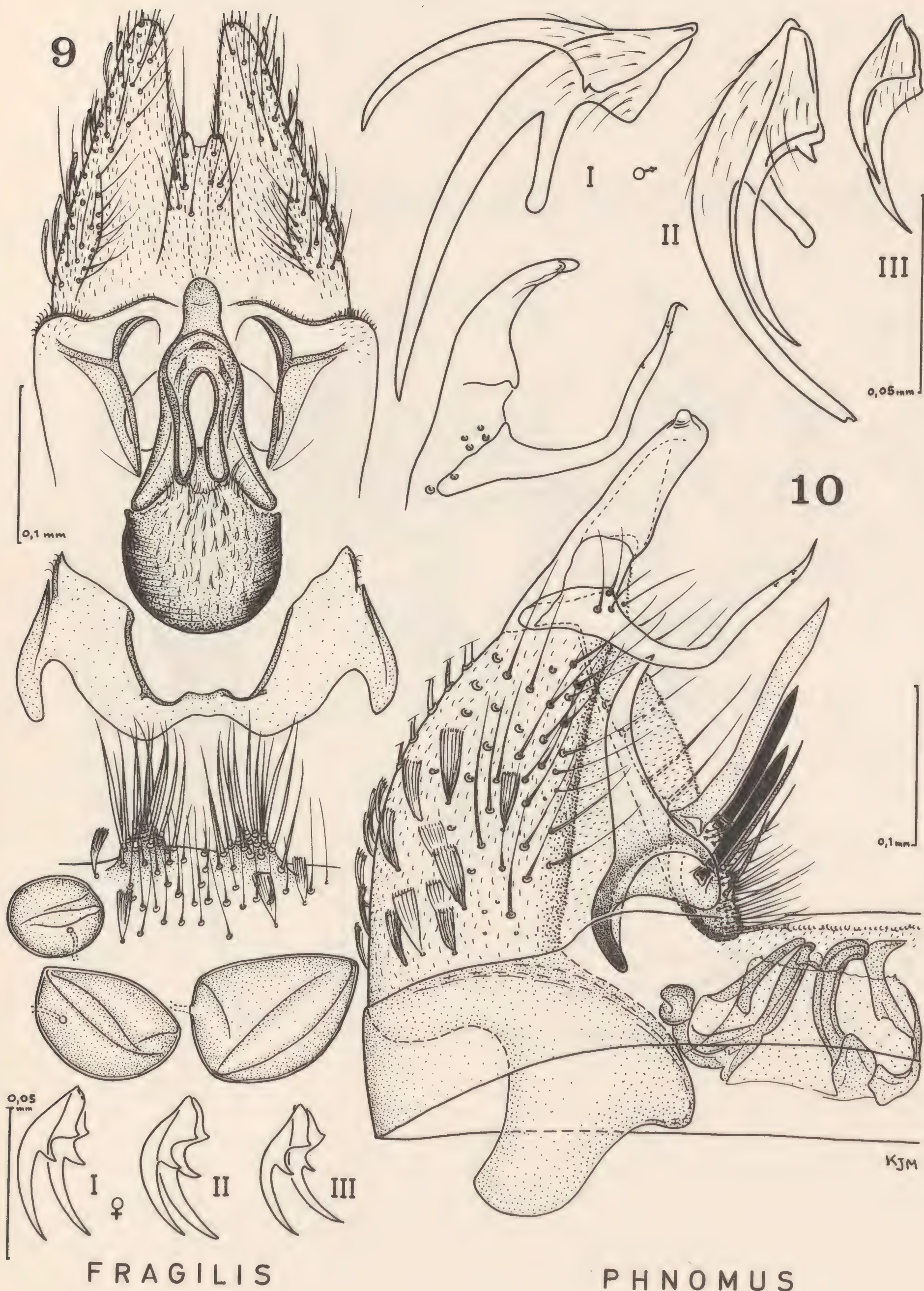








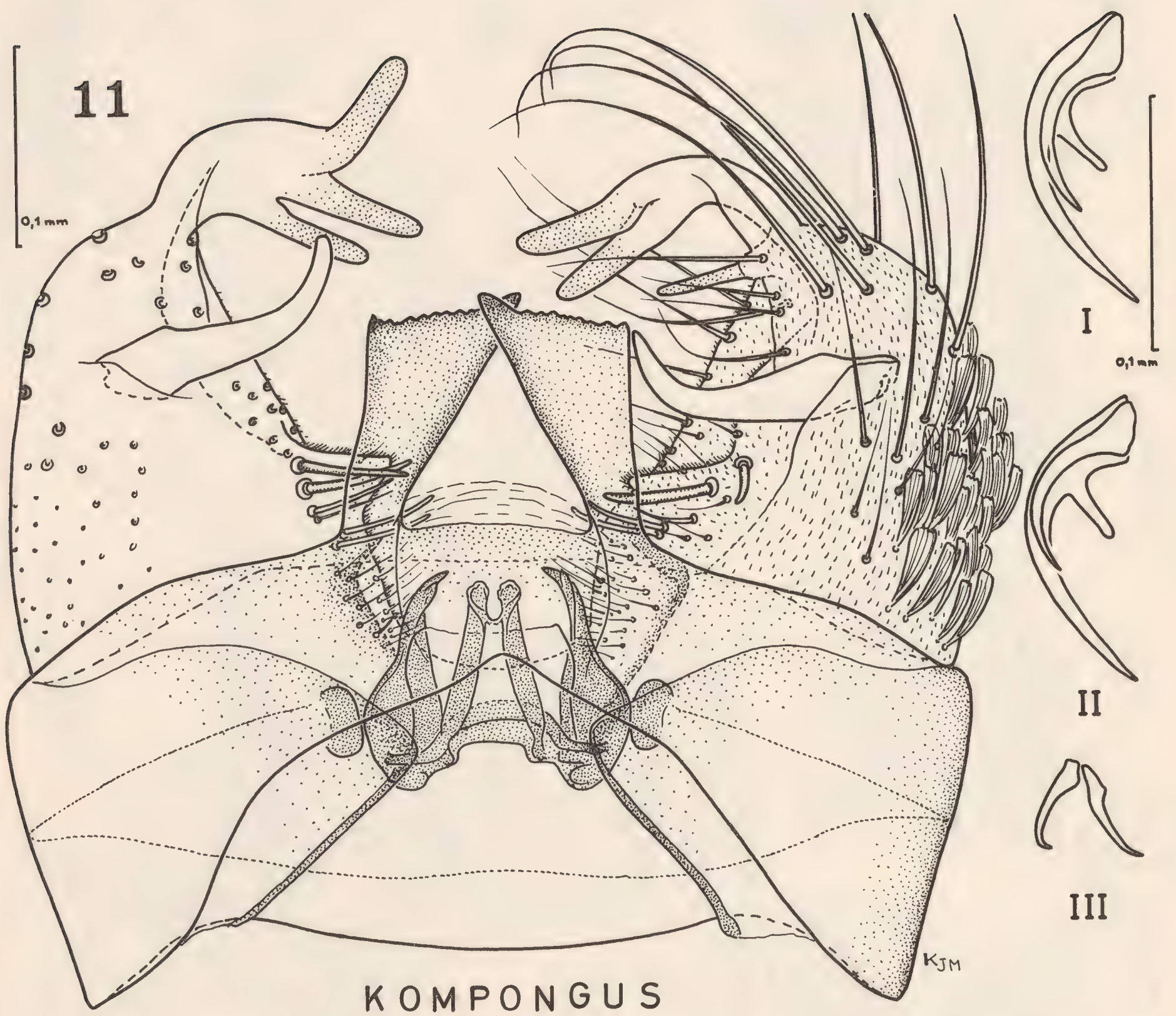




FRAGILIS

PHNOMUS







## INDEX

Italicized pages are those which begin the primary treatment of the taxon. Numbers in parenthesis refer to figures illustrating the species in question.

andamanensis	1, 2, 7, 8, 9, 12, 14
cautus	2
clavatus	1, 2, 13, 14
cretatus	1, 2, 3, 5, 12, 14
cyrtolabis	1, 2, 3, 4, 13, 15, (17)
dermajoensis	1, 2, 4, 5, 12, 13, (16)
dux	1, 5, 12, 13
fragilis	1, 2, 5, 6, 10, 11, 13, 14, (19)
hamistylus	10, 11
hispidus	8
incertus	5, 7
indecorabilis	1, 2, 6, 10, 11, 12, 13, (18)
indicus	9
khmerus	1, 5, 7, 12, 14, (16)
kompongus	1, 8, 12, 14, (20)
notabilis	2, 9, 13
pahangi	10, 11
panayensis	2, 5
phnomus	9, 12, 14, (19)
protuberans	4
rarus	7
robertsi	10
siamensis	2
stungus	1, 2, 5, 10, 11, 12, 13, (17)
torosus	4
uncus	2, 4, 11, 13, 15
uniformis	6
vallistris	1, 2, 10, 11, 12, 14